UNIT NO. 1

ENTERAL FEEDING

Dr Matthew Ng Joo Ming

ABSTRACT

Advances in the field of clinical nutrition have introduced a wide range of formulations to the market. Today physicians are faced with a bewildering choice of formulations. Increasingly, patients are being discharged to the community from the restructured hospitals with enteral tube feeding. It is important for the family physician to be familiar with the types of formulations and the different enteral tubes. These tubes need to be changed on a regular basis and the family physician in the community will likely be called upon to provide such services. The enteral route is always preferable to parenteral provided there are no contraindications such as ileus, gastrointestinal ischaemia, or bilious and persistent vomiting. Enteral tubes are easy to insert and cheap, and the insertion can be done at the bedside. It is important to confirm the correct placement of the tube in the stomach before initiating feeding as the tube may be coiled, twisted or malpositioned in the respiratory tract. This can be done by aspiration of the stomach contents and testing it with pH paper. In the case of an unconscious patient, this can be done with a chest X-ray.

Keywords:
Enteral Feeding, Choice Of Nutrition Formulas, Confirmation Of Tube Placement.

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INTRODUCTION

The best way of obtaining nutrition physiologically is via the oral route. However, when illness prevents a patient from normal intake, support is needed. The maintenance of appropriate nutrition in patients with chronic and acute illness is well recognised as a fundamental part of standard medical and surgical care. Patients who are malnourished have poorer clinical outcomes, more complications and infections, and use more resources compared to well-nourished patients. In hospitalised patients, this can be delivered enterally or parenterally. Enteral nutrition is generally preferred to parenteral because of its relative simplicity, safety, and lower cost, well as its ability to maintain mucosal barrier function. There are several ways of delivering enteral feeding; the methods, intragastric or transpyloric is dependent on the availability of safe and easy oral/nasal access. Intragastric feeding (nasogastric or gastrostomy) is generally preferred as they are most physiological, but the transpyloric (nasoduodenal, nasojejunal or jejunostomy) may be selected if there is increased risk of aspiration, gastrointestinal reflux, and in cases where the primary disease affects the stomach. Short-term access is usually achieved using nasogastric (NGT) or nasojejunal (NJT) methods. Percutaneous endoscopic gastrostomy (PEG) or jejunostomy should be considered if feeding is planned for longer than one month (Figure 1). However, in practice NGT is the most commonly encountered form of tube-feeding in home-based care.

MATTHEW NG JOO MING
Consultant
Department of Family Medicine and Continuing Care
Singapore General Hospital

NASOGASTRIC TUBES

NGTs are the most commonly used delivery route and the most commonly encountered in home-care patients and patients in the nursing homes. It is a narrow-bore tube that is passed into the stomach via the nose. In children, the orogastric route is used as infants are obligate nose breathers. It is used for short- to medium-term nutritional support, and also for aspiration of stomach contents (decompression of intestinal obstruction). In adults, the transnasal approach may not always be possible because of anatomic abnormalities and tumours, where placing a tube from the nose to the stomach can lead to complications.

Placement of the nasogastric tubes is relatively safe and can be performed at the bedside with minimal training. However, it can be easily dislodged by the patient. Furthermore, placing a nasogastric tube may be hazardous in patients with altered consciousness who will not be able to cooperate adequately with swallowing or indicate inadverant misplacement of the tube into the trachea. The choice of tubes is dependent on the desired duration of feeds. A wide-bore tube is used if drainage is needed; otherwise a finer-bore tube can be used. Fine-bore tubes cause less discomfort and have a lower risk of rhinitis, pharyngitis or oesophageal erosion. Polyurethane or silicone feeding tubes are unaffected by the gastric acid and can remain in the stomach for longer periods than PVC tubes, which can only be used for less than a month. After placement, it is essential to confirm the correct placement of the tube before feeding. This can be done by testing the pH of the aspirate and with radiological confirmation (Figures 2 and 3). Gastric placement is indicated by a pH less than 4. The old practice of introducing a small quantity of air in the stomach and checking for bubbling sound over the epigastrium is no longer recommended as it is unreliable and can give false reassurance. Gastric feeding is more physiological, convenient and easier. It also allows greater flexibility in terms of choice of formulas and feeding regimen. The stomach is able to tolerate a larger volume and higher osmotic load than the upper small intestine. The feeding regimen can be bolus by gravity or continuous by pump system. Bolus feeding is simple, requiring minimal equipment, but increases the risk of gastrointestinal symptoms. Continuous feeding requires expensive equipment (Figure 3). It reduces the rate of gastrointestinal symptoms but the patient is connected to the system most of the time and it limits mobility. Other forms of tube feeding may have to be considered if the patient has recurrent aspiration, gastroesophageal reflux and delayed gastric emptying.

NASOJEJUNAL (NJT) AND NASODUODENAL (NDT) TUBES

The placement of a feeding tube beyond the pylorus is necessary in patients who are intolerant of intragastric feeding or in the presence of the following factors:

1. Recurrent aspiration;
2. Severe gastrointestinal reflux and oesophagitis;
3. Post-surgery/multiple trauma;
4. Gastric and anteroduodenal dysmolity; or
5. Patients on paralytic agents.

The placement of such tubes is difficult but may be aided by intravenous prokinetics and under direct observation endoscopically. The ideal placement is into the distal duodenum or jejunum, beyond the ligament of Treitz. An adequately sited post-pyloric tube that is verified radiologically virtually eliminates aspiration and is less likely dislodged even with persistent coughing and vomiting. However, because the tubes used are of a smaller bore compared to nasogastric tubes, the risk of intestinal perforation and tube occlusions is higher.

GASTROSTOMY AND JEJUNOSTOMY TUBE

Percutaneous endoscopic gastrostomy feeding tubes (PEG) were first described in 1980 for use in children. It is now becoming more common and increasingly in use in both adults and children who require long-term enteral nutrition. Besides endoscopic techniques, gastrostomy tubes can also be placed surgically or radiologically. Indications for their use include difficulties with oral intake where obstruction to the upper airway or gastrointestinal tract makes passing a nasogastric tube difficult. This can result from an acute ischaemic or haemorrhagic stroke and chronic progressive neuromuscular disease. In children, they are commonly used in patients with neurological disorders with inability to swallow or dysphagia and craniofacial abnormalities. This method of feeding tethers the gastric wall to the abdominal wall, exposing it to excoriations and infections. The tubes used are of a larger bore and less prone to obstruction. The absolute contraindications to their use are coagulopathies, acute severe illness, ascites, previous gastric surgery, and gastric outlet obstruction.

Placement of a jejunostomy tube endoscopically or surgically may be required in patients with significant delay in gastric emptying and antroduodenal motility. Such tubes can be used for feeding immediately, however there is a risk of infection at the percutaneous site and formation of a fistula after removal.

COMPLICATIONS OF TUBE PLACEMENT AND FEEDING

The reported rates of complication related to **PEG tube placement** vary from 16% to 70%. Complications of gastrostomy placement can be seen any time following the tube placement.[1,2] Immediately following tube placement pneumoperitoneum, ileus, and perforation of the oesophagus or stomach can occur. Other complications that can be seen at any time include infection, bleeding, peristomal leakage, and inadvertent tube removal. Peristomal leakage usually occurs within the first few days after tube placement though it may also be seen in patients with a mature gastrostomy tract. Treatment includes management of comorbidities such as malnutrition and hyperglycaemia, and local measures to address skin breakdown such as powdered absorbing agents or a skin protectant such as a paste of zinc oxide. Placement of a larger-size gastrostomy tube through the same gastrostomy tube tract will not solve the problem. Placing a larger-bore tube will just serve to distend and distort the tract further and will not promote wound healing. If the tract has time to mature (i.e., up to 4 weeks after placement), the tube can be temporarily removed for 24 to 48 hours, permitting the tract to close slightly, and a replacement gastrostomy tube can then be placed through the same partially closed tract. Sometimes it may be necessary to remove the tube and allow the tract to close completely and a new tube placed at a different location on the abdominal wall. The tube may also be inadvertently removed by a delirious or confused patient. If the gastrostomy tract has had time to mature (i.e., at least 4 to 6 weeks old), a replacement tube or Foley catheter may be placed through the gastrostomy tract. The tract will begin to close within 24 hours so placement of a replacement tube should not be delayed. Those tubes that are inadvertently removed within 4 weeks of placement should not be blindly replaced at the bedside. The tract in such a situation may not have matured adequately and the abdominal wall and gastric wall may have separated. Replacement of the tube will result in placement in the peritoneal cavity. The tract can be allowed to heal and then a new gastrostomy can be placed at a different site or, alternatively, the tube can be replaced endoscopically through the original tract.

The **nasogastric or nasoenteric tubes** in the gastrointestinal tract can become malpositioned, coiled or knotted anywhere along the course of the tube.[3,4] The tube impairs the normal function of the lower oesophageal sphincter, making the patient more susceptible to reflux of gastric content, leading to oesophagitis, gastrointestinal bleeding and pulmonary aspiration. The tubes can also cause gastric bleeding through chronic irritation or pressure necrosis due to suctioning of the gastric mucosa. In addition, a rare complication is perforation of pulmonary structures or the gastrointestinal tract. The tubes require changing once every 1 to 3 months depending on the materials. Family physicians need to be aware that medications prescribed need to be crushed before they can be fed through the enteral tubes. Certain medications such as enteric coated tablets, sublingual formulations, sustained release tablets cannot be crushed and need to be substituted. Proper techniques of feeding of formulas and medications need to be instituted to prevent blockages of the tubes. (See Table 1-3: Jane Tan, Matthew Ng. Enteral nutrition. SFP 2008; 34(4):70-76). Blocked tubes can be unblocked by flushing with water, a warm solution of sodium bicarbonate, pancreatic enzymes, or fizzy cola drinks.[5]

Figure 1: Types of tubes (adapted from SFP 2008; 34(4):70-76)[5]

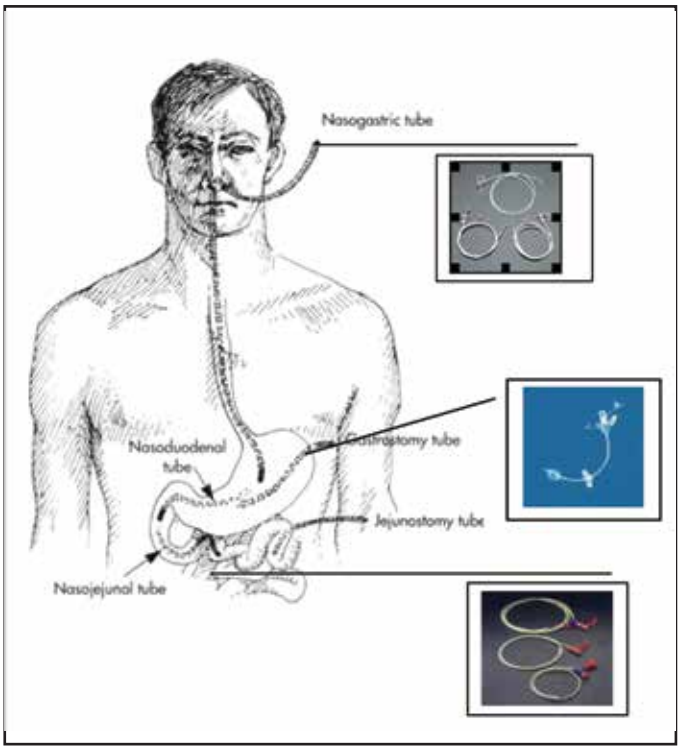

Figure 2: Enteral feeding kit (kidney dish, gallipot, pH papers and syringe)

Figure 3: Compact pump for continuous NGT feeding

Figure 4: Chest X-ray to check placement of NGT

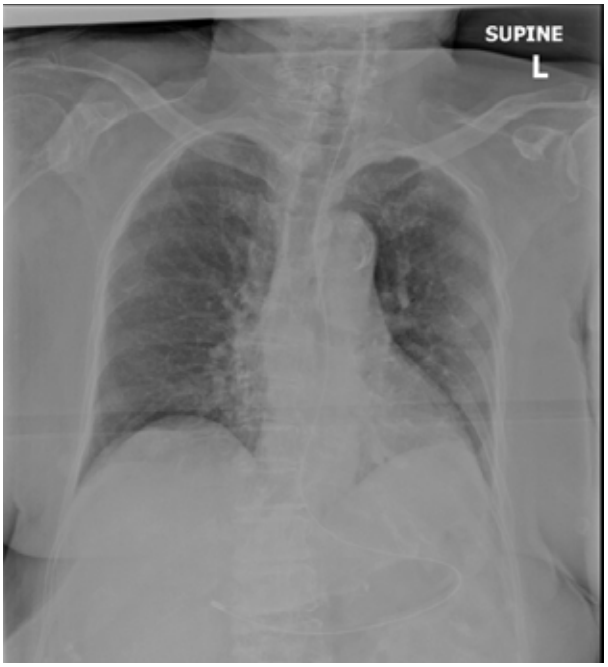

Table 1: Types of enteral formulas

Type	Description	Calorie	Protein (g/L)	Osmolality (mmosm/kg H_2O)	Flavour	Cost (SGH retail pharmacy)
A. Standard patients with low / normal calorie requirement						
Ensure powder/liquid	Low saturated fats Lactose free, gluten free	1.0	37.2	555	Vanilla Chocolate	$31.55 per tin
					Strawberry	$2.40 per can
IsoCal	No fiber	1.0	34	270	Nil	$2.30 per pkt
B. Standard patients with high calorie requirement						
Ensure Plus	Less saturated fats, quality protein, gluten free	1.5	54.9	690	Vanilla Chocolate Strawberry Banana Raspberry	$2.80 per pkt
Resource 2.0	High protein and calorie	2.0	84	790	Vanilla Chocolate	$4.64 per pkt
C. Diabetic Patients						
Glucerna	Reduced carbohydrate Low cholesterol MUFA Lactose and Gluten free Not for Galactosaemia	1.0	41.8	355	Vanilla	$3.31 per tin
Nutren DM	As above Has unique fibre	1.0	38	-	Vanilla	$3.25 per pkt
D. Renal Patients						
Nova source renal	Dialysis patient: High protein Calorically dense Low phosphate/K /Calcium High folate/B6	2.0	69.9	635	Vanilla	$3.95 per pkt
Suplena	Non dialysis patient Low protein Calorically dense Low phosphate/Na High folate/B6	2.0	30	600	Vanilla	$4.90 per can
E. Respiratory patients						
Pulmocare	Ventilator, COPD, cystic fibrosis High calorie, low carbohydrate 20% fat as MCT Antioxidants	1.5	62.6	475	Vanilla Chocolate	$3.76 per can
F. Patients with gastrointestinal symptoms						
Jevity	High-fibre Isotonic, lactose and gluten free	1.0	44.3	310	Nil	$2.41 per can
G. High Protein						
Prosure	For cancer patients EPA (omega 3) High-quality protein Low fat Vitamins, Minerals	1.25	69.9	635	Vanilla	$30.51 per 380g tin
Propass/Myotein	Protein supplement High-quality concentrated protein	30 cal/scoop	-	6g/scoop	Nil	$14.36/$16.81 per tin
H. Special formulas						
Peptamen	Predigested feeds Protein broken down to peptides For patients with short gut syndrome	-	-	-	Nil	$42.80 per tin

Patients who are severely malnourished and those who have lost a lot of weight are at risk of **refeeding syndrome** during the first two weeks of refeeding.[6,7,8] The syndrome is characterised by hypophosphataemia, cardiovascular collapse, rhabdomyolysis, seizures and delirium. The rapid changes in metabolism and electrolyte movement during the anabolic stage lead to other cardiovascular and neurological manifestations. Wernicke's encephalopathy, manifesting as delirium can occur during refeeding in Thiamine-deficient patients. Hence, besides monitoring of vital signs and electrolyte abnormalities, physicians should also look out for impairment of cognitive function and signs of congestive failure during refeeding. In susceptible patients, feeds should be started slowly, all depleted electrolytes replaced, and thiamine added to the patient's treatment regimen.

ENTERAL NUTRITION

Enteral nutritional support refers to the provision of calories, protein, electrolytes, vitamins, minerals, trace elements and fluids via an intestinal route. To initiate enteral nutrition, appropriate access must be obtained and the prescription needs to be determined. The prescription includes formulation, composition, delivery strategy, and delivery rate. The patient's BMI, recent weight changes and factors such as illness are taken into account during assessment of patient's nutritional requirements.[9,10,11]

Nutritional requirements can be estimated. Most patients will require 30kcal/kg/day in terms of energy requirement. The ideal body weight of the patient should be used for calculating nutritional requirements. A patient's needs may vary greatly from his metabolic state. The average patient receiving nutritional intervention requires 0.8 to 2.0g protein/kg. The goals are to minimise protein breakdown, preserve lean body mass, and promote protein synthesis and optimised immune response. When in doubt, the family physician should consider asking the advice of a dietician to formulate the amount of nutritional requirements for the patient.

A healthy adult ingests approximately 1ml free water/kg of energy or 30-35ml/kg/day. Wide variations in fluid intake are normally well tolerated without producing any problems. However, the amount of water will need to be restricted in patients with liver, renal, cardiovascular, pulmonary disease and closed head injury. On the other hand, patients with diarrhoea, hypovolaemia and burns will require additional fluid.

Nutritional repletion therapy increases electrolyte requirements and these need to be replaced based on laboratory results and the patient's clinical state. There is also a need for adequate vitamins and trace minerals. A minimum of 2.4% of total calories should be given as linoleic acid daily to prevent essential fatty acid deficiency.

There are many products available for enteral nutrition. Most are formulated to provide 100% of recommended daily vitamin and mineral requirements when a minimum of approximately 1000 or more kilocalories are delivered per day. Adult enteral products fall into one of the following categories: general use, high nitrogen and calorie, fibre-enriched semi-elemental, fat-modified, and specialty. When selecting a formula for patients, both the formula's characteristics and patient's specific conditions and comorbidities should be considered. Most formulas currently available are isotonic and are well tolerated at full strength when delivered into the small intestine (Table 1).

CONCLUSION

Nutritional support and supplementation can achieve significant improvements in the nutritional status of patients that the Family Physician commonly encounters in home care. All elderly patients living alone and in nursing homes should be screened for malnutrition. This reduces significant morbidity and mortality. Oral, enteral or parenteral nutritional support, alone or in combination, should be considered for people who are either malnourished or at risk of malnutrition. Nutrients are delivered enterally via a nasogastric tube, or via PEG in patients with swallowing problems. This is the preferred route to deliver nutrition in patients with a functional gastrointestinal system and it is simpler and cheaper than total parenteral nutrition.

Many nutritionally complete formulas are available commercially (Table 1). The patient's underlying medical condition and comorbidities should be taken into account during the selection of formulas to be used. Further, physicians in home care should have a good understanding of tubes available, and the prevention and management of complications associated with tube feedings. Regular haematological and biochemical tests may be needed, particularly in an unstable patient. Close monitoring of water balance, electrolytes, osmolarity, and blood urea is required in order to prevent electrolyte disturbances, volume overload and hyperosmolarity syndrome. Complications of enteral feeding are not common, are usually not serious and can be overcome with careful monitoring. Up to 20% of patients may have diarrhoea and gastrointestinal discomfort from intolerance of a major nutrient, or of a major nutrient component, or of the osmotic fluid load of the formula. Home enteral feeding also places a considerable burden on the family or other carers, who therefore require adequate training and ongoing support.

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LEARNING POINTS

- **Nutritional advice, support, and supplementation can achieve significant improvements in nutritional status and reduction in morbidity and mortality.**
- **Nutritional supplements should be given orally unless contraindicated. Gastric feeding via NGT should be initiated if there are swallowing problems, but the gastrointestinal tract must be functional.**
- **Enteral feeding places a considerable burden on the patient and family. They will require adequate training and ongoing support.**
- **Many nutritional formulas are available commercially. The choice of which formula to use will depend on the patient's medical conditions and comorbidities, taking into account the patient's water, energy, protein and electrolyte requirements.**
- **Nutritional supplementation should be started slowly in patients who are severely malnourished and who have suffered significant weight loss. They are at risk of refeeding syndrome.**